REMARKS

As required in the "Notice of Non-Compliant Amendment (37 CFR 1.121)" mailed January 30, 2006, a copy of the signed Amendment as filed on January 17, 2006 is attached.

Action on the merits is respectfully solicited.

Respectfully submitted,

Date: February 1, 2006

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PETITION and
DEPOSIT ACCOUNT CHARGE AUTHORIZATION

This document and any concurrently filed papers are believed to be timely. Should any extension of the term be required, applicant hereby petitions the Director for such extension and requests that any applicable petition fee be charged to Deposit Account No. 50-1645.

If fee payment is enclosed, this amount is believed to be correct. However, the Director is hereby authorized to charge any deficiency or credit any overpayment to Deposit Account No. 50-1645.

Any additional fee(s) necessary to effect the proper and timely filing of the accompanying-papers may also be charged to Deposit Account No. 50-1645.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of:

Sung-jin KIM et al.	Art Unit: 2634
Serial No. 09/909,858	Examiner: S.C. Pathak
Filed: July 23, 2001	*Confirmation No. 8771*
For: TRANSMISSION ANTENNA DIVERSITY METHOD, AND BASE STATION APPARATUS AND MOBILE STATION APPARATUS THEREFOR IN MOBIL COMMUNICATION SYSTEM (To be amended)	Attorney Docket No. 249/271

AMENDMENT UNDER 37 C.F.R. § 1.111

Mail Stop Amendment
Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

INTRODUCTORY COMMENTS

In response to the Office action dated December 9, 2005, the following amendments and remarks are respectfully submitted in connection with the above-identified application:

Amendments to the Title begin on page 2 of this paper.

Amendments to the Specification being on page 3 of this paper.

Amendments to the Claims are reflected in a listing of claims, which begins on page 4 of this paper.

Remarks begin on page 9 of this paper.

AMENDMENTS TO THE TITLE:

Kindly amend the title as follows:

--CLOSED LOOP TRANSMIT DIVERSITY METHOD AND APPARATUS USING COMPLEX BASIS VECTOR SETS FOR ANTENNA SELECTION--

AMENDMENTS TO THE SPECIFICATION:

Kindly cancel the first occurrence of page 1 in its entirety.

Kindly replace the paragraph on page 5, lines 4-13 with the following:

In an embodiment of the present invention, a closed loop transmission antenna diversity method employing a selective combining method includes ~~comprises the steps of~~ (a) measuring channel information from signals ~~received through~~ transmitted from a plurality of antennas used in a base station and outputting a channel information matrix; (b) transforming the channel information matrix according to a transform matrix composed of a complex basis vector set; (c) calculating reception power with respect to the plurality of antennas based on the transformed channel information matrix; (d) obtaining transmitting antenna selection information based on the calculated reception power; and (e) transmitting the antenna selection information to the base station as feedback information for controlling transmission antenna diversity.

Kindly replace the paragraph on page 6, lines 10-20 with the following:

In still another embodiment of the present invention, a channel information measuring unit in a receiving mobile station apparatus measures signals ~~received~~ transmitted from a plurality of antennas in a base station and creates a channel information matrix which is processed by a basis vector transformer to transform the channel information matrix according to a transform matrix composed of a complex basis vector set, after which an optimum weight detector calculates reception power with respect to the plurality of antennas based on the transformed channel information matrix, after which a feedback information signal generator for controlling transmission antenna diversity based on the calculated reception power, and to an uplink signal processor for transmitting the feedback information to the base station in the form of a symbol configured according to a protocol suitable for feedback.

Kindly cancel page 29 in its entirety.

AMENDMENTS TO THE CLAIMS:

Following is a listing of all claims in the present application, which listing supersedes all previously presented claims:

Listing of Claims:

1. (Currently Amended) A closed loop transmission antenna diversity method employing a selective combining method when a plurality of antennas are used in a base station of a mobile communication system, the closed loop transmission antenna diversity method comprising the steps of:

(a) measuring channel information from signals ~~received through~~ transmitted from the plurality of antennas used in the base station and outputting a channel information matrix;

(b) transforming the channel information matrix according to a transform matrix composed of a complex basis vector set;

(c) calculating reception power with respect to the plurality of antennas based on the transformed channel information matrix; and

(d) transmitting antenna selection information obtained based on the calculated reception power to the base station as feedback information for controlling transmission antenna diversity.

2. (Original) The closed loop transmission antenna diversity method of claim 1, wherein the step (a) comprises measuring channel information using pilot signals set differently for the plurality of antennas.

3. (Original) The closed loop transmission antenna diversity method of claim 1, wherein the step (b) comprises the sub steps of:

(b1) calculating a first transformed channel information matrix from the channel information matrix using a transform matrix composed of a first basis vector set; and

(b2) calculating a second transformed channel information matrix from the channel information matrix using a transform matrix composed of a second basis vector set, and

the step (c) comprises the sub steps of:

(c1) calculating reception power based on the first and second transformed channel information matrices; and

(c2) detecting an element maximizing the reception power in the complex basis vector set.

4. (Original) The closed loop transmission antenna diversity method of claim 3, wherein the first and second basis vector sets are a Walsh basis vector set and a polar basis vector set, respectively.

5. (Original) The closed loop transmission antenna diversity method of claim 1, wherein the step (d) comprises alternately transmitting two indexes corresponding to a real part and an imaginary part, respectively, of a complex basis vector at feedback signaling intervals when an index corresponding to a basis vector included in the complex basis vector set is transmitted as the feedback information.

6. (Original) The closed loop transmission antenna diversity method of claim 1, wherein in the step (d) the feedback information signal comprises antenna selection information and phase information indicating a phase difference between antennas.

7. (Original) A closed loop transmission antenna diversity method employing a selective combining method, comprising the steps of:

(a) receiving in a base station selection information related to a complex basis vector from a mobile station;

(b) determining a complex basis vector selected based on the selection information;

(c) obtaining an antenna weight for each antenna using the determined complex basis vector; and

(d) generating a signal based on the antenna weight and transmitting the signal to the mobile station through a corresponding antenna.

8. (Original) The closed loop transmission antenna diversity method of claim 7, comprises the additional steps after step b):

(b1) receiving an index corresponding to an element of a complex basis vector set as the feedback information; and

(b2) selecting a complex basis vector corresponding to the index received in step (b1) by referring to a weight table in which an index is assigned to each element of a complex basis vector set composed of all combinations of first and second basis vector sets.

9. (Original) The closed loop transmission antenna diversity method of claim 7, wherein the step (a) comprises separately receiving as the feedback information the real part and imaginary part of an index corresponding to an element of a complex basis vector set for two feedback signaling intervals, and combining the real part and the imaginary part by way of sliding window.

10. (Original) The closed loop transmission antenna diversity method of claim 8, wherein the first and second basis vector sets are a Walsh basis vector set and a polar basis vector set, respectively.

11. (Original) In a mobile communication system, a base station apparatus, having a plurality of antennas for a closed loop transmission antenna diversity method employing a selective combining method, comprising:

a plurality of antennas for receiving selection information related to a complex basis vector from a mobile station as feedback information;

a feedback information decoder for determining a complex basis vector selected based on the selection information and obtaining an antenna weight for each antenna using the determined complex basis vector; and

a data transmitting unit for generating a signal based on the antenna weight and transmitting the signal to the mobile station through a corresponding antenna.

12. (Original) A mobile station apparatus for a closed loop transmission antenna diversity method employing a selective combining method when a plurality of antennas are used in a base station of a mobile communication system, the mobile station apparatus comprising:

a channel information measuring unit for measuring channel information from signals transmitted ~~received~~ through the plurality of antennas used in the base station and outputting a channel information matrix;

a basis vector transformer for transforming the channel information matrix according to a transform matrix composed of a complex basis vector set;

an optimum weight detector for calculating reception power with respect to the plurality of antennas based on the transformed channel information matrix and generating feedback information for ~~controlling transmission~~ antenna selection ~~diversity~~ based on the calculated reception power; and

an uplink signal processor for transmitting the feedback information to the base station in the form of a symbol configured according to a protocol suitable for feedback.

13. (Original) The mobile station apparatus of claim 12, wherein the basis vector transformer comprises:

a Walsh basis vector transformer for transforming the channel information matrix using a transform matrix composed of a Walsh basis vector set; and

a polar basis vector transformer for transforming the channel information matrix using a transform matrix composed of a polar basis vector set.

14. (Original) The mobile station apparatus of claim 12, wherein the optimum weight detector comprises:

first and second column adders each for adding elements in all columns in each row in the transformed channel information matrix and outputting a row vector;

a combiner for combining the outputs of the first and second column adders in all possible cases and outputting a combination matrix;

a power calculator for calculating power with respect to each element of the combination matrix; and

a maximum value detector for detecting a maximum value of the power with respect to each element and outputting an index of an element corresponding to the maximum value.

15. (Original) The mobile station apparatus of claim 12, wherein the uplink signal processor transmits antenna selection information and phase information as the feedback information.

16. (New) The closed loop transmission antenna diversity method of claim 1, wherein the complex basis vector set is an orthonormal vector set.

17. (New) The closed loop transmission antenna diversity method of claim 7, wherein the complex basis vector set is an orthonormal vector set.

18. (New) The closed loop transmission antenna diversity method of claim 11, wherein the complex basis vector set is an orthonormal vector set.

19. (New) The mobile station apparatus of claim 12, wherein the complex basis vector set is an orthonormal vector set.

REMARKS

Prior to entry of this amendment, claims 1-15 are currently pending in the subject application. Claims 16-19 have been added. Claims 1, 7, 11 and 12 are independent. No new matter has been added.

Applicants appreciate the Examiner's acknowledgement of applicants' claim for foreign priority and receipt of a certified copy of the priority document.

Applicants further appreciate the Examiner's acceptance of the drawings filed on July 23, 2001.

Applicants further appreciate the Examiner's consideration of applicants' Information Disclosure Statements, filed September 27, 2001 and October 24, 2003.

Claims 1-19 are presented to the Examiner for further or initial prosecution on the merits.

A. Introduction

In the outstanding Office action, the Examiner objected to the specification, rejected claims 1-6 and 12-15 under 35 U.S.C. § 112, first paragraph, as failing to comply with the enablement requirement, rejected claims 1, 5-7, 9, 11, 12 and 15 under 35 U.S.C. § 103(a) as being unpatentable over the Applicant Admitted Prior Art (AAPA) in view of U.S. Patent No. 5,634,199 to Gerlach et al. ("the Gerlach '199 reference") in further view of Hottinen et al. "Transmit Diversity using Filtered Feedback Weights in the FDD/WCDMA System", 2000 IEEE, February 2000, pages 15-21 ("the Hottinen et al. reference"), rejected claim 2 under 35 U.S.C. §103(a) as being unpatentable over the APAA in view of the Gerlach '199 and the Hottinen et al. references, further in view of U.S. Patent 5,471,647 to Gerlach et al. ("the Gerlach '647 reference"), and indicated that claims 3, 4, 8, 10 and 13-14 recite allowable subject matter.

B. Asserted Objections to the Specification

In the outstanding Office action, the Examiner objected to the Specification for containing duplicate pages and duplicate matter on different pages. By the instant amendment, the first occurrence of page 1 and page 29 have been deleted in their entirety.

The Examiner also objected to the title as not being descriptive. The title has been amended generally as suggested by the Examiner.

The Examiner also noted inconsistencies on page 5, line 6 and page 6, lines 10-11. These have been corrected by the instant amendment as suggested by the Examiner.

Therefore, it is respectfully submitted that the instant amendment addresses all of the objections, and it is respectfully requested that these objections be withdrawn.

C. Asserted Rejection of Claims 1-6 and 12-15

In the outstanding Office action, the Examiner rejected claims 1-6 and 12-15 under 35 U.S.C. § 112, first paragraph, as failing to comply with the enablement requirement. Claims 1 and 12 have been amended to be consistent with the changes made to pages 5 and 6 of the specification above. Therefore, it is respectfully submitted that these claims are enabled by the specification, and it is respectfully requested that this rejection be withdrawn.

D. Asserted Obviousness Rejections of Claims 1, 2, 5-7, 9, 11, 12 and 15

In the outstanding Office action, the Examiner rejected claims 1, 5-7, 9, 11, 12 and 15 under 35 U.S.C. § 103(a) as being unpatentable over the AAPA in view of the Gerlach '199 reference further in view of the Hottinen et al. reference, and rejected claim 2 under 35 U.S.C. § 103(a) as being unpatentable over the APAA in view of the Gerlach '199 and the Hottinen et al. references, further in view of the Gerlach '647 reference. These rejections are respectfully traversed for at least the reasons set forth below.

All of the independent claims 1, 7, 11 and 12 recite using complex basis vectors to select an antenna from the plurality of antennas. For example, claim 1 recites, in part, "transmitting antenna selection information;" claims 7 and 11 each recite, in part, "transmitting the signal to the mobile station through a corresponding antenna;" and claim 12 recites, in part, "generating feedback information for antenna selection."

The Hottinen et al. reference is relied on by the Examiner as teaching the use of complex weighting vectors. First, it is respectfully submitted that these complex weighting vectors are not equal to the complex basis vectors recited in the pending claims. As can be seen in claims 7, 11 and 12, and as shown, for example, in the equation on page 26, line 12, the complex weight may be determined from the complex basis vector set. Further, since the Hottinen et al. reference is directed to a maximum ratio combining (MRC) method, in which the power of all antennas is combined, rather than selecting one from a plurality of antennas, as in the SC method of the present invention, and as clearly recited in the independent claims, absent the teachings of the present invention, there is no disclosure or suggestion to combine any complex basis vector of the Hottinen et al. reference with the SC method of the AAPA.

Further, the Gerlach '647 reference additionally relied on in rejecting claim 2 fails to provide these teachings.

Therefore, it is respectfully submitted that neither AAPA, the Gerlach '199 reference, the Hottinen et al. reference, nor the Gerlach '647 reference, either alone or in combination, disclose or suggest the present invention as recited in the independent claims. The remaining rejected claims depend, either directly or indirectly, from corresponding ones of the base claims, and are therefore believed to be allowable for at least the reasons set forth above. Therefore, it is respectfully requested that these rejections be withdrawn.

E. New Claims

Claims 15-19 depend from claims 1, 7, 11 and 12, respectively, and further recite that the basis vector set is an orthonormal vector set, as disclosed, for example, on page 8, line 19 to page 9, line 3 of the original specification. These claims are believed to be allowable for at least the reasons their respective base claims are considered allowable.

F. Allowable Subject Matter

The indication that claims 3, 4, 8, 10 and 13-14 contain allowable subject matter is gratefully acknowledged. However, it is respectfully submitted that all of the claims are in condition for allowance for at least the reasons set forth above.

G. Conclusion

Since the cited prior art references neither anticipate nor render obvious the subject invention as presently claimed, applicants respectfully submit that claims 1-19 are now in condition for allowance, and a notice to that effect is respectfully requested.

If the Examiner believes that additional discussions or information might advance the prosecution of the instant application, the Examiner is invited to contact the undersigned at the telephone number listed below to expedite resolution of any outstanding issues.

In view of the foregoing amendments and remarks, reconsideration of this application is earnestly solicited, and an early and favorable further action upon all the claims is hereby requested.

Respectfully submitted,

LEE & MORSE, P.C.

Date: January 17, 2006

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